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*Tutorial Article*

# Manual lymph drainage for equine lymphoedema-treatment strategy and therapist training

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## Introduction

Idiopathic primary lymphoedema ('swollen legs') and secondary lymphoedema following trauma or infection (e.g. wound oedema or phlegmon/cellulitis) are frequently encountered problems in equine veterinary practice. At present, therapy of these diseases is often based on symptomatic and empirical treatment, using NSAIDs, antibiotics and compression bandages (**Fig 1**). Less consideration is given to the underlying disturbance of the lymphatic system. In order to understand the susceptibility of horses to lymphoedema better, it must be remembered that the horse is a flight animal, normally in constant movement. Modern methods of keeping horses in box housing, with limited free exercise and concentrated training sessions compromise the lymph system in apparently healthy horses, particularly in the feet (Laue, 1987). Under these conditions, even minor trauma (e.g. skin wounds) can lead to serious oedema.

**Manual lymph drainage (MLD) is a treatment option applied directly to the lymphatic system. Furthermore, this method does not contravene anti-doping regulations and has no side effects. Although established for decades in human medicine (Földi *et al.* 2006), it is only slowly gaining a foothold in veterinary medicine.**

## Basis and principles of manual lymph drainage

### *Anatomy*

Manual lymph drainage is primarily based on the stimulation of contraction of lymph vessels by a specific manual technique in order to increase the transport of lymphatic fluid. The technique also causes interstitial tissue fluids to be drawn into the initial lymph vessels (ILV) of the skin.

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The ILV of the dermis form a network of superficial lymph capillaries and deeper precollectors. The precollectors are connected with collectors in the deeper dermis as first described in the horse by Berens von Rautenfeld and Rothe (2002). With the exception of the lymph capillaries, all other lymph vessels contain valves that determine the direction of flow and prevent reflux.

Tissue fluids flow into the ILV. Because there are interendothelial openings and no basal membrane filter in the ILV (Berens von Rautenfeld and Claus 2003; Berens von Rautenfeld and Drenckhahn 2004), large volumes of tissue fluid including macromolecules can enter the lumen.

In the horse, MLD techniques can stimulate contraction of both the epifascial (superficial) and the subfascial (deep) collectors. In man, MLD stimulation of subfascial collectors is usually impossible because of the relatively thick subcutis of

a) b)

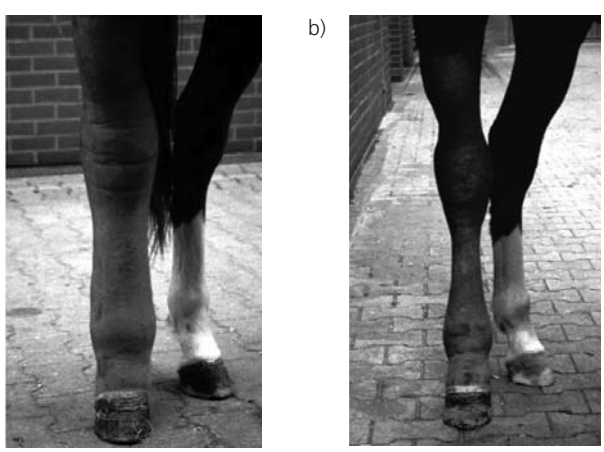

***Fig 1: Horse (2-year-old Warmblood stallion) before (a) and after (b) MLD treatment. Chronic phlegmon/cellulitis in the right hind leg of 2 years duration. Previous treatments: antibiotics, corticosteroids, NSAIDs, diuretics, bandaging, hydrotherapy, Percutin[1] (Ingredients/ml: phenylbutazone 0.05 g; Niaouli oil 0.01 g; benzyl nicotinate 0.001 g; DMSO 0.9 g), sweat bandages (after Rötting* et al. *2000).***

the extremities. Unlike man and cattle, horses and dogs have only few smooth muscle cells in all collectors (Meyer 1988; Neu and Berens von Rautenfeld 1994; Berens von Rautenfeld and Schacht 2003; Neu 2003) which can be stimulated to contract by MLD. Despite this, MLD is more effective in horses than in man. An additional transport system for lymph dynamics in this species must be present. Harland (2003) demonstrated a high proportion of elastic fibres (nearly 40%) in all parts of collectors in the horse (**Fig 2**). This elastic retraction apparatus could play an important role in MLD and compression treatment.

Myofibroblasts, which occur in the subendothelial *intima* of the collectors in horses (Harland 2003), may also play an important role in the effectiveness of MLD techniques. McClosekey *et al.* (2002) have shown that myofibroblasts exert a 'pacemaker' activity in sheep enteric lymphatic vessels. Such an activity might explain why MLD in horses may stimulate collectors outside, as well as inside the area where the technique is applied.

When applied to superficial lymph nodes, MLD stimulates peri- and intranodal lymph dynamics and the immune system (because of increased recirculation of lymphocytes from the intranodal blood system). It also enhances reabsorption of lymph in the intranodal blood system (Renkin 1989).

### *Central preliminary treatment*

Central preliminary treatment is one of the most important prerequisites for effective MLD. This pretreatment activates the main lymphatic trunks in the body cavities and the collectors in the neck and body wall. This resulting suction effect makes it possible for lymph to be transported away from the oedematous area. The lymph drainage areas of the regional lymph nodes (or lymphocentres) are called territories (**Fig 3**). According to Baum (1928) there are 7 territories in each half of the horse's body. The areas bordering adjacent territories ('watersheds') have a significantly smaller number of connecting subcutaneous collectors, but the network of initial lymph vessels and dermal collectors is always present.

The first step in central preliminary treatment is activation of superficial cervical lymph nodes in order to increase the main direction of flow of the thoracic duct to the left venous angle (**Fig 3**; 1a). Activation of the afferent collectors from regional lymph nodes of Territory III follows (**Fig 3**; 1b).

The jugular trunk is then stimulated on both sides (**Fig 3**; 2). In man, deep abdominal drainage is used as a very effective method for activation of the lymphatic trunks and the chyle cistern in the body cavities. However, anatomical differences make this method impractical in the horse. To activate these structures, the subiliac lymph nodes and their afferent collectors are stimulated (**Fig 3**; 5a,b). The subiliac lymph nodes drain the lymph to the iliac lymph nodes. The latter are the collecting lymph nodes for the whole hind leg, the pelvic cavity and the upper, rear body Territory. Transterritorial drainage of lymph from Territory VII to Territories III and IV is an important way of overcoming any blockages of the lymphatic trunks or the thoracic duct.

### *Treatment strategy for the hind leg*

There is generally a special treatment strategy for each affected body region. The example described here is the strategy for treating lymphoedema of the hind leg. The hind leg is one of the regions most frequently affected by lymphoedema in the horse (Dietz 1999; 2004).

Following preliminary treatment as described above, manual lymph drainage is carried out on several parts of the leg in a proximal to distal direction (Rötting 1999; Berens von Rautenfeld *et al.* 2000), according to the pathways and the direction of the venous and lymphatic vessels.

The first step is activation of the superficial and deep inguinal lymph nodes (**Fig 3**; 7a), which are mostly not palpable, and their afferent collectors. If there is a blockage in these lymph nodes, a transterritorial treatment should be performed by applying manual drainage over the watersheds between Territory VII and Territories III, IV and VI (**Fig 3**; 3, 4, 8).

Because of the very thin subcutis in horses (Laue 1987), epi- and subfascial collectors run near the skin from tarsus to hoof. Therefore, MLD can stimulate both systems to contract. The lymph of the caudolateral, subfascial collectors flows directly into the deep popliteal lymph nodes.

### *Technique*

It is not possible to provide an exact theoretical description of the specialised MLD grips. These must be learned from practical demonstration and require practice. Important aspects of these techniques are application over a wide surface (**Fig 4**) and their duration (e.g. 2–3 s). Manual lymph drainage is applied in circular, flowing motions biphasically with increasing (push phase) and decreasing pressure (relief phase) on the skin. The motion is always performed in the direction of the lymph flow. During the push phase, the ILV empty into the collectors. In the relief phase, the ILV are dilated by the anchoring filaments so that the tissue fluid can flow into the vessels.

An MLD treatment session takes 30–45 min depending on the afflicted region (excluding time for bandaging). At first, MLD must be performed daily, but once results are seen this can be reduced to 2–3 times a week. It is best to continue MLD until oedema is eliminated completely. In horses with chronic cellulitis, prophylactic MLD is recommended to maintain success.

## Compression

Use of compression is another important aspect of the treatment of lymphoedema. To optimise the results of MLD, a special compression bandage must be applied afterwards. The bandage increases tissue pressure and therefore tissue fluid flow into the lymph vessels is supported. In addition the bandage increases the pressure gradient from distal to proximal, which also supports lymph flow. This bandage is thickly padded with special cotton wool[2] to stop sliding. Because the bandage should not cause constriction, thick padding especially at bone

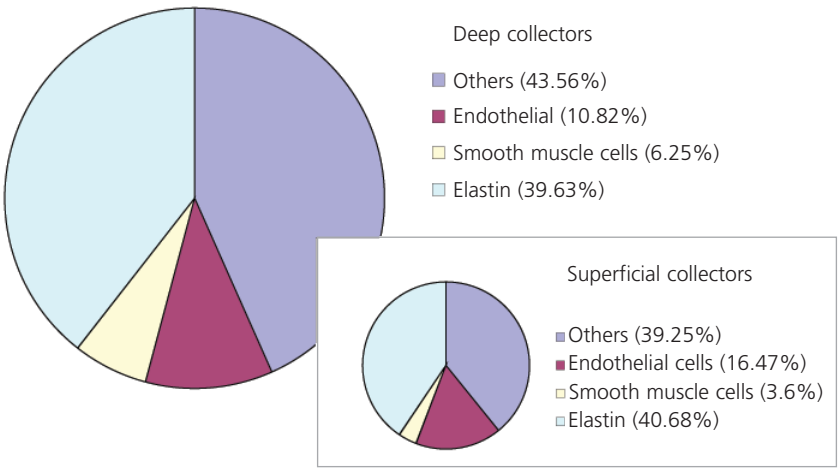


***Fig 2: The percentage of smooth muscle cells, elastin, endothelial cells and other components (e.g. collagen) in superficial and deep lymph collectors of horses.***

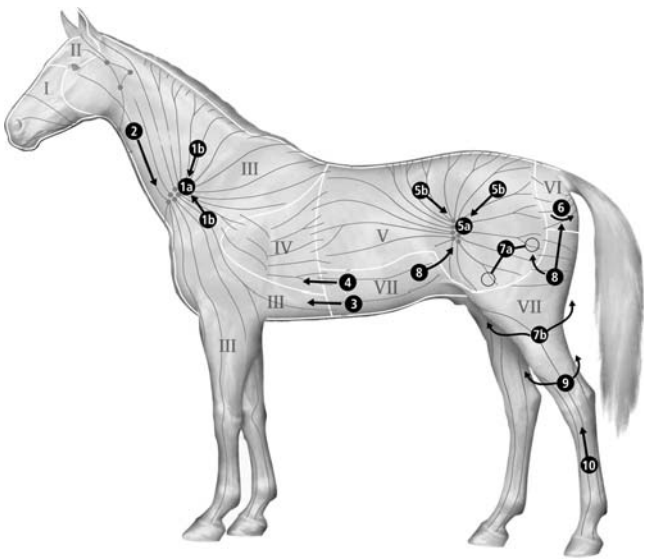


***Fig 3: The treatment concept for manual lymphatic drainage is presented in 10 steps in respect to the dermal territories (I-VII), omitting the head. The specialised manual technique of lymphatic massage is not presented. Steps 1–6 are the central pretreatment for manual lymphatic drainage of the left hindlimb: 1a) Activation of superficial cervical lymph nodes (Lnn.* cervicales superficiales*); 1b) Activation of the afferent lymph vessels of Territory III; 2) Activation of the jugular trunk of both sides in direction of the deep caudal cervical lymph nodes (Lnn.* cervicales profundi caudales*, circle); 3) Transterritorial treatment from Territory VII to III via the transversal watershed; 4) Transterritorial treatment from Territory VII to IV via the transversal watershed; 5a) Activation of the subiliac lymph nodes (Lnn.* subiliaci*); 5b) Activation of the afferent lymph vessels around the subiliac lymph nodes; 6) Activation of the afferent lymph vessels of Territory VI to anorectal lymph nodes. Manual lymph treatment of the hind limb follows a proximal-to-distal direction: 7a) Activation of the deep and superficial inguinal lymph nodes (Lnn.* inguinales superficiales et profundi*); 7b) Activation of the afferent lymphatics of Territory VII draining to the inguinal lymph nodes (circles); 8) Transterritorial treatment from Territory VII to Territory V and VI; 9) Activation of the deep collectors to the popliteal lymph nodes (Lnn.* poplitei profunda*); 10) Activation of the superficial and deep collectors of the foot (after Berens von Rautenfeld* et al. *2000).***

***Fig 4: Manual lymph drainage grips, application over a wide surface.***

projections and natural cavities, is necessary. The leg must have an even, cylindrical contour (**Fig 5**). The bandage is wrapped with specialised short stretch bandages. This kind of bandage exerts low resting and high working pressure. This means that the pressure increases beneath the bandages during movement, and therefore lymph vessels are emptied but not compressed and lymph fluid increases.

The therapist must start the bandage on the shin, wrapping fast with low pressure down to the hoof, fix the cotton wool quickly, then, wrapping with more pressure in a proximal direction. Large bandages up to the elbow or knee are done in 2 parts whereby the distal part is the supportive structure for the proximal part. Once the bandage is finished, the horse must be trotted to ascertain that no constriction results from movement (**Fig 6**).

An elastic stocking, with a high proportion of elastic fibres, corresponding to those of equine collectors, is currently being tested for prophylactic use.

## Exercise

Exercise is also part of the complete treatment strategy, for additional stimulation of the lymph flow. Optimally, the patient should be exercised (without bandages) before the MLD, and if possible also after treatment (with bandages). The gallop is the best gait for increasing the lymph flow (because the negative intrathoracic pressure which is generated during breathing is high), but the nature of the disease will determine which exercise strategy is appropriate. If the bandage is put on properly, it allows exercise in walk and trot, as well as free movement in a paddock or at grass. Paddock and pasture must be dry and even.

## Indications and contraindications

Generally any kind of lymphoedema is an indication for MLD. Manual lymph drainage can also be used alone or as an auxiliary therapy in all diseases involving the lymphatic vessels. Studies in horses from case series have reported the successful use of MLD in the treatment of chronic phlegmon/cellulitis (Rötting 1999; Rötting *et al.* 2000) and of post operative oedema after median coeliotomy (Brandhorst 2004). Manual lymph drainage is useful for the treatment of post traumatic oedema, because it enhances transport of exudate and inflammatory cells. In human medicine this is a regular indication, and it has been confirmed for horses in several cases. Manual lymph drainage can also aid or speed healing of poorly healing wounds, this indication has also been proved in human medicine (Strößenreuther 2003). A. Rötting (personal communication) had used MLD as auxiliary treatment in 10 cases of tendonitis, resulting in a clearly shortened recovery time. Research in man has shown that MLD strongly increases lactate elimination from the muscles (Bringezu 1994), and MLD is used as prophylactic treatment for high performance athletes (Strößenreuther 2003). Our own results in using MLD as auxiliary treatment in equine rhabdomyolysis syndrome and tying-up syndrome have confirmed this. The treated horses showed less muscle symptoms and faster recovery. A prophylactic use in high performance horses (e.g. endurance horses) analogous to man appears to be efficient. The technique may also be of benefit in the treatment of laminitis, as it lowers pressure in the hoof capsule. Individual cases of laminitis have recently been treated successfully (K. Phillips, personal communication). In human mammary oedema MLD is a standard treatment (Földi *et al.* 2003), e.g. after cancer operation with mammary conservation. In horses MLD treatment of mammary oedema due to mastitis has taken place in individual cases, allowing a subsequent local use of antibiotics (C. Ballat, personal communication). In acute cellulitis (phlegmon) MLD can be used in afebrile phases (only by veterinarians!) to speed the reduction of oedema, which has been confirmed during our own treatments several times.

Manual lymph drainage is contraindicated in cases with left cardiac insufficiency as additional lymph fluid would increase cardiac pre-load. Furthermore, it is contraindicated for all neoplastic diseases, because MLD could induce metastasis. Although MLD may be contraindicated when fever is present, in individual cases the veterinarian uses MLD if antibiotic protection against septicaemia is provided.

There is an urgent need for scientific studies on the indications for MLD such as equine rhabdomyolysis syndrome. In this way, the indications for MLD in equine veterinary medicine may be properly established.

***Fig 5: Specialised compression bandages used during the training programme.***

***Fig 6: Testing compression bandages by trotting.***

## Training

At present, training of equine MLD therapists is offered mainly in German speaking countries. The course comprises approximately 28 h over 3 days of intensive training. Only veterinarians and physiotherapists (trained in MLD in man) are admitted to these courses. Training veterinarians and physiotherapists together makes sense, because veterinarians do not receive extensive training in MLD techniques. Veterinarians benefit from the presence of the physiotherapists, who have more practice in this area. Because there are only few trained MLD physiotherapists for humans in the UK, in such countries training of veterinarians should be emphasised, with special focus on intensive training in manual techniques. The training courses are held in equine clinics, such as the Clinic for Horses at the University of Veterinary Medicine Hannover Foundation. The trained physiotherapists are required to work together with a veterinary surgeon. Clients cannot be directed to use any of the techniques on their horses, because this needs intensive training. However, a special type of grooming to activate the lymphatic system has been developed for lay persons.

## Conclusions

Manual lymph drainage is a new therapy to equine veterinary medicine. However, it has been used successfully for decades in human medicine for several indications (Földi *et al.* 2006). It is used to treat various types of lymphoedema and prophylactically, for example in high performance human athletes (Bringezu 1994; Strößenreuther 2000). The range of indications has not been established in veterinary medicine. Considering the advantages of the method, there is no reason why MLD should not be used in horses. Correctly applied, MLD has no side effects. Horses tolerate the therapy well, even when painful areas are touched. MLD does not contravene anti-doping regulations, an advantage which should not be underestimated as it permits MLD to be used to treat sport and racehorses at any time. Even prophylactic application is possible; this seems quite promising, for example to prevent the tying-up syndrome in racehorses. From the veterinarian's point of view, one disadvantage might be the length of time MLD takes in comparison to conventional therapy. Normally MLD treatment takes from 30–40 min, excluding the additional time needed to apply the specialised bandage required where there are problems of the extremities. Veterinarians should therefore work together with specially trained physiotherapists. The veterinarian can prescribe and supervise the treatment, while the physiotherapist performs the time consuming part. Nevertheless, such an arrangement is only possible if specially trained equine MLD physiotherapists are available. At present, this remains a problem in the UK.

Generally speaking, MLD is a very interesting therapeutic option for horses, because, like man, they are very prone to lymphoedema. This is due to the fact that equine lymph collectors have only few smooth muscle cells in comparison to other domestic mammals and humans (Meyer 1988; Harland 2003), among other factors.

In summary, MLD should be a standard therapy, known by all veterinarians. It can be used alone or in combination with other treatments for diseases of the lymphatic system and for those involving this system.

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[2]Albrecht GmbH, Aulendorf, Germany.

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